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Engineering Note

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Project: Dzero General Support
Doc. No: H010125A (Dzero Eng. Note 3823-000-EN-558)

Subject: Description of the Dzero High Sensitivity Smoke Detector System (HSSD)

Contents:

1 Overview

There are nine separate zones of high sensitivity smoke detection (HSSD) at Dzero. These zones, their coverage, their condition thresholds, and their response to conditions are described in the table in the "Zones & Responses" section of this document.

This is an "air-sampling" smoke detection system. Each zone is formed of a network of pipes which contain strategically sized and located air sampling holes. Each zone has a fanbox/detector head that continuously draws air into the holes and through the pipes to the detector head where it is evaluated for combustion products. The fanbox/detector heads are located on the Dzero detector platform and in the trusses. Each fanbox/detector head has a remotely located display control card (DCC) for monitoring the level of obscuration of the air sample. This remote equipment is located on the roof of the moving counting house. The DCC for each zone is networked to a single intelligent interface module (IIM), also on the roof of the MCH, that collects the information from all nine zones and delivers it to the Dzero control room via an isolated RS-485 link to an operators console. This console is replicated via a "remote video, keyboard, mouse system" in the DAB 4th floor entry lobby for use by fire response personnel. Internal thresholds that have been set in the DCC via the operators console provides alarm level 1 (lowest), alarm level 2, and alarm level 3 (highest) for each zone. These alarms are then used as inputs to the Fermilab FIRUS system, and as interlocks to equipment.

This system is nearly 2000 times more sensitive than conventional smoke detectors. It is sensitive enough to detect invisible products of combustion such as the outgassing of electrical components, overheating PVC wire insulation, or small changes in the ambient level of obscuration caused in the incipient stage of a fire.

2 Responsibility for Maintenance

Fermilab's Facilities Engineering Support Services Department (FESS) is responsible for maintenance of this system from the detector fan boxes, up to and including the control equipment located on the roof of the moving counting house. The Dzero Project Electrical Engineer is responsible for the user consoles in the control room and the lobby, and the isolated RS-485 link to the IIM on the counting house roof. The Project Electrical Engineer and the Dzero resident Safety Boss have the passwords to modify parameters in the HSSD system however, the proper procedure is to contact the "Fire Techs" at X8504 or P-0269 for matters related to the hardware or configuration of this system.

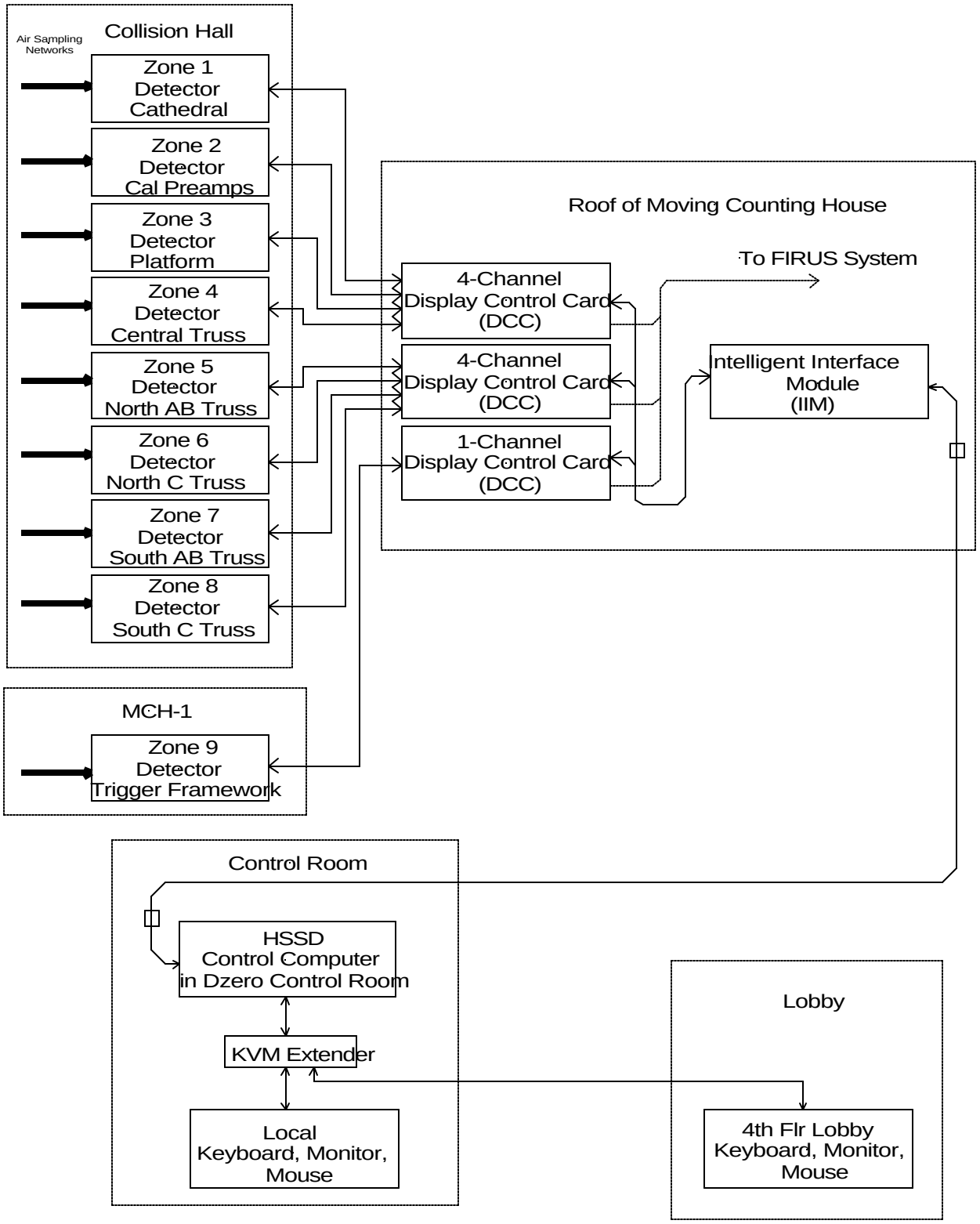
As built drawings of the entire system including the air sampling tube networks and the electrical drawings are maintained by FESS. Copies of these drawings are also maintained by the Dzero Project Electrical Engineer.

3 Zones & Responses

Note that all FIRUS messages are displayed in the Fermi Communications Dispatch Center, Dzero Control Room, and Fermi Main Control Room.

Vesda Zone	Coverage	Condition	Response
Cathedral	Silicon Detector interface racks and all of central cathedral area	Trouble (power, airflow, detector, cpu, isolated)	FIRUS message "VESDA Fire Panel Trouble"
		Alarm 1 (50%, 15 Sec)	FIRUS message "VESDA Pre-alarm"
		Alarm 2 (100%, 15 Sec)	Interlock disable of SMT interface power supplies
		Alarm 3 (100%, 15 Sec)	FIRUS message "VESDA Hi-alarm"
Cal Preamp	Calorimeter preamp boxes	Trouble (power, airflow, detector, cpu, isolated)	FIRUS message "VESDA Fire Panel Trouble"
		Alarm 1 (50%, 15 Sec)	FIRUS message "VESDA Pre-alarm"
		Alarm 2 (100%, 15 Sec)	Interlock disable of Cal Preamp power supplies
		Alarm 3 (100%, 15 Sec)	FIRUS message "VESDA Hi-alarm"
Platform	All of platform including central, north, and south area.	Trouble (power, airflow, detector, cpu, isolated)	FIRUS message "VESDA Fire Panel Trouble"
		Alarm 1 (20%, 1 Sec)	FIRUS message "VESDA Pre-alarm"
		Alarm 2 (30%, 5 Sec)	Interlock disable of VLPC power supplies
		Alarm 3 (50%, 10 Sec)	FIRUS message "VESDA Hi-alarm" **Initiates bldg alarms and dispatch fire trucks**
Central Truss	Central Muon truss devices (PDT power supplies and free-standing VME crates) in all levels east and west	Trouble (power, airflow, detector, cpu, isolated)	FIRUS message "VESDA Fire Panel Trouble"
		Alarm 1 (50%, 20 Sec)	FIRUS message "VESDA Pre-alarm"
		Alarm 2 (100%, 60 Sec)	Reserved - Interlock contact available on platform
		Alarm 3 (100%, 60 Sec)	FIRUS message "VESDA Hi-alarm" **Initiates bldg alarms and dispatch fire trucks**
North AB Truss	North Muon A & B layer truss devices (MDT paks, PDT power supplies, free-standing VME crates), top and sides	Trouble (power, airflow, detector, cpu, isolated)	FIRUS message "VESDA Fire Panel Trouble"
		Alarm 1 (50%, 15 Sec)	FIRUS message "VESDA Pre-alarm"
		Alarm 2 (100%, 30 Sec)	Reserved
		Alarm 3 (100%, 30 Sec)	FIRUS message "VESDA Hi-alarm"
North C Truss	North C Layer Truss Devices, top and sides	Trouble (power, airflow, detector, cpu, isolated)	FIRUS message "VESDA Fire Panel Trouble"
		Alarm 1 (50%, 20 Sec)	FIRUS message "VESDA Pre-alarm"
		Alarm 2 (100%, 60 Sec)	Reserved
		Alarm 3 (100%, 60 Sec)	FIRUS message "VESDA Hi-alarm" **Initiates bldg alarms and dispatch fire trucks**
South AB Truss	South Muon A & B layer truss devices (MDT paks, PDT power supplies, free-standing VME crates), top and sides	Trouble (power, airflow, detector, cpu, isolated)	FIRUS message "VESDA Fire Panel Trouble"
		Alarm 1 (50%, 15 Sec)	FIRUS message "VESDA Pre-alarm"
		Alarm 2 (100%, 30 Sec)	Reserved
		Alarm 3 (100%, 30 Sec)	FIRUS message "VESDA Hi-alarm"
South C Truss	South C Layer Truss Devices, top and sides	Trouble (power, airflow, detector, cpu, isolated)	FIRUS message
		Alarm 1 (50%, 20 Sec)	FIRUS message "VESDA Pre-alarm"
		Alarm 2 (100%, 60 Sec)	Reserved
		Alarm 3 (100%, 60 Sec)	FIRUS message "VESDA Hi-alarm" **Initiates bldg alarms and dispatch fire trucks**
Trigger Framework	MCH-1 Trigger Framework on MCH1 south, and top of trigger racks in vicinity of m324.	Trouble (power, airflow, detector, cpu, isolated)	FIRUS message
		Alarm 1 (50%, 15 Sec)	FIRUS message "VESDA Pre-alarm"
		Alarm 2 condition (100%, 15 Sec)	Interlock disable of Trigger Framework
		Alarm 3 (100%, 15 Sec)	FIRUS message "VESDA Hi-alarm"

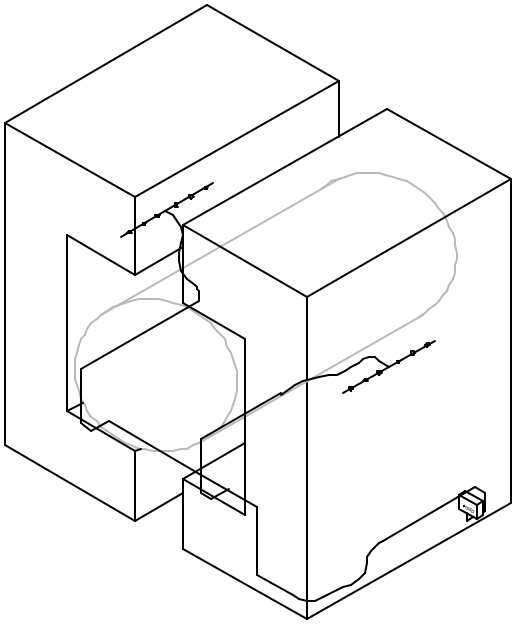
4 System Block Diagram



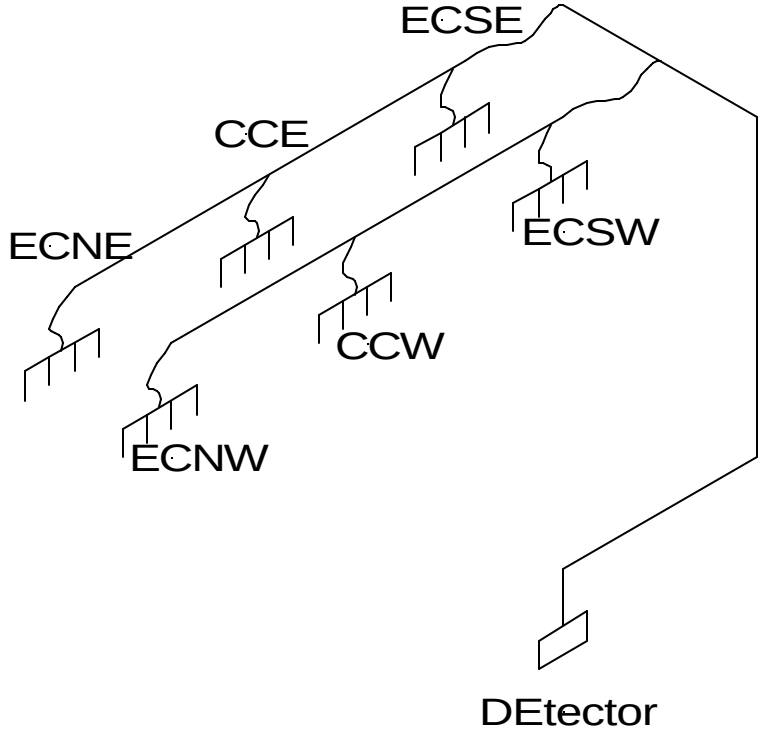
5 Configuration of Air Sampling Systems

The following isometric sketches are for general topographical information only. Full drawings are maintained by FESS with copies in the project Engineer's office.

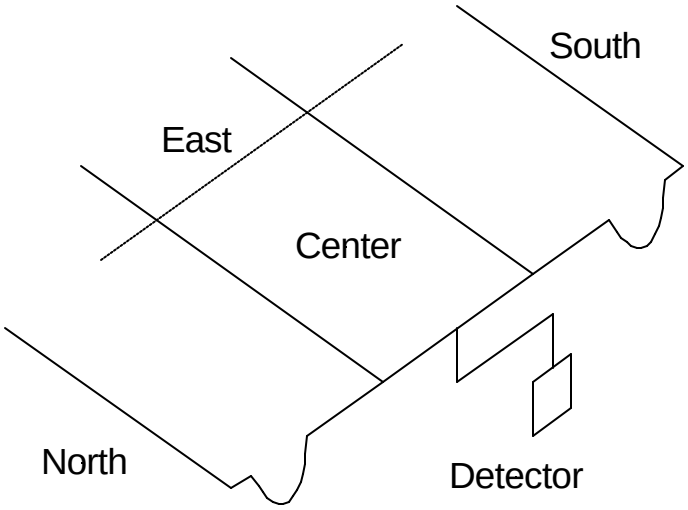
5.1 Zone 1 - Cathedral



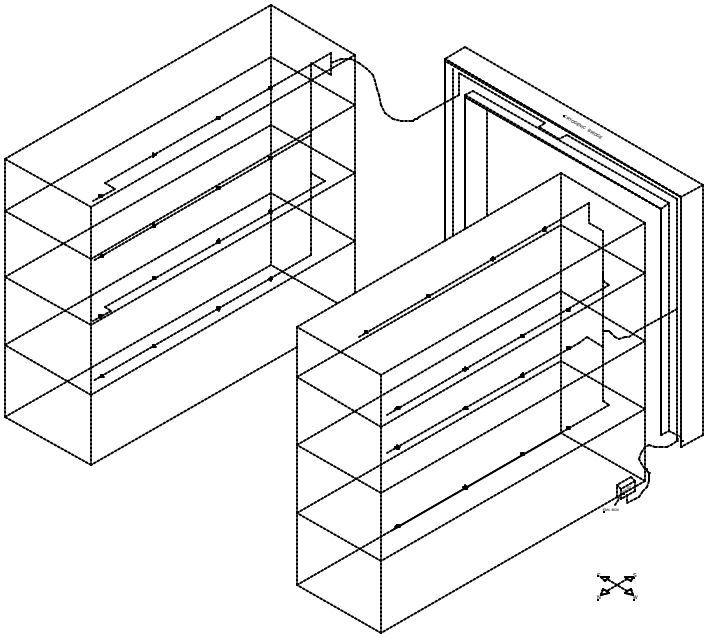
5.2 Zone 2 - Calorimeter Preamp



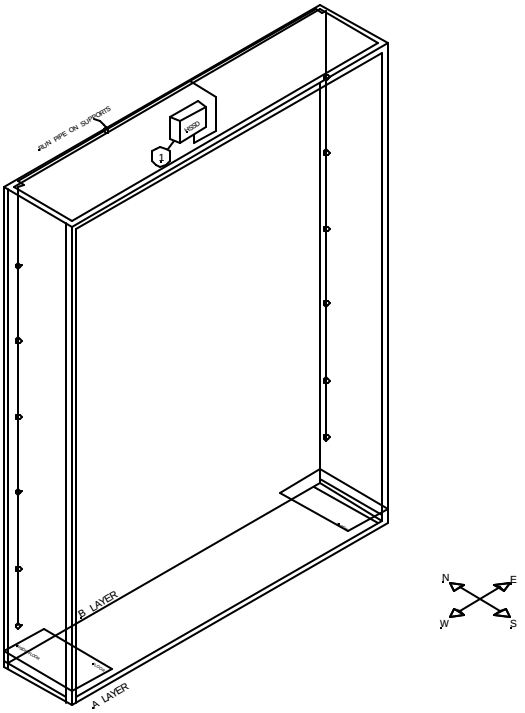
5.3 Zone 3 - Platform



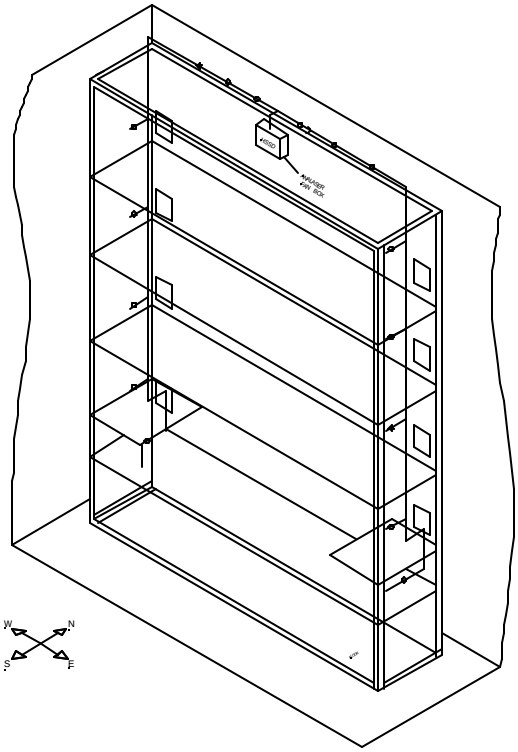
5.4 Zone 4 - Central Truss



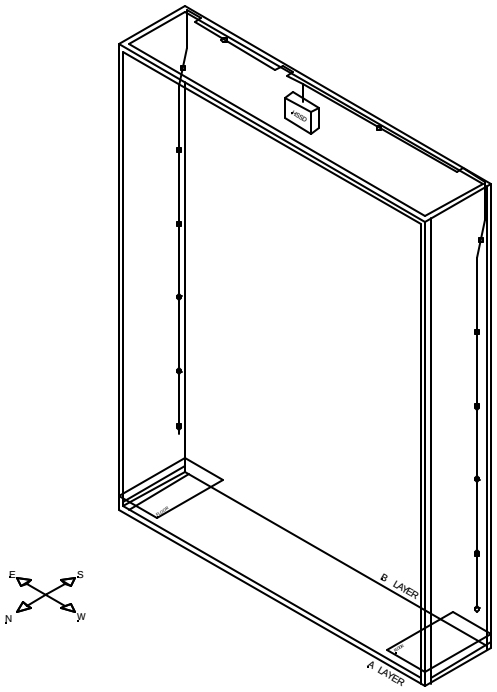
5.5 Zone 5 - North AB Truss



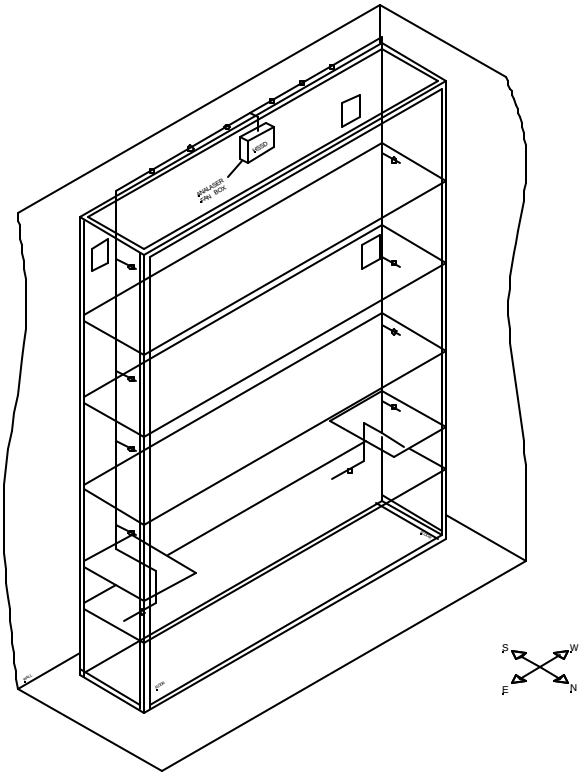
5.6 Zone 6 - North C Truss



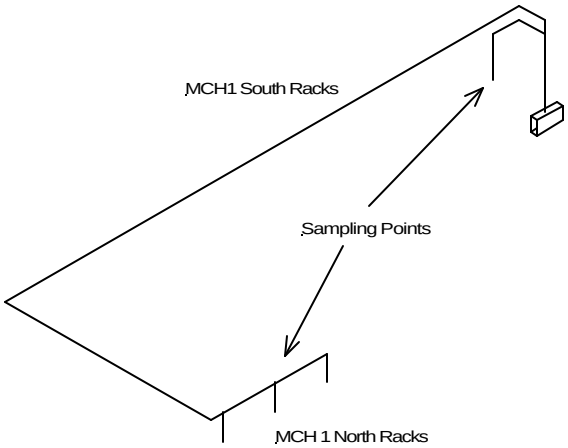
5.7 Zone 7 - South AB Truss



5.8 Zone 8 - South C Truss



5.9 Zone 9 - Trigger Framework



6 Maximum Response Times to Smoke

These values were obtained by releasing smoke detector testing agent into the sampling hole farthest from the detector.

System	**Maximum Response Time (Seconds)**
Cathedral	15
Cal Preamp	68
Platform	15
Central Truss	40
North AB Truss	8
North C Truss	10
South AB Truss	5
South C Truss	5
Trigger Framework	6

7 Reference Documents

Document	Name & Location
Conceptual Specification - Initial spec for approval	Engineering Note H000810A - Rick Hance - Files
HSSD Interconnection - MCH Roof to PW06 - Lists every signal connecting equipment on top of MCH to Detector heads on platform and in MCH1	Engineering Note H010123A - Rick Hance - Files
MCH Roof Top Controls - Drawing of Roof top support structure and equipment placement	Engineering Note H001213A - Rick Hance - Files
Equipment Data Sheets	Rick Hance Files
LaserNet Software Instructions	Rick Hance Files
As Built Piping Isometric Drawings	Rick Hance Files - FESS Files
Response Times Document	Engineering Note H010202A - Rick Hance - Files
Suction Pressures Document	Engineering Note H010202B - Rick Hance - Files
Wiring to Control Room PC	Engineering Note H010322A - Rick Hance - Files
Installation, Operation, & Maintenance Manual	FENWAL Doc #89.58 - Rick Hance Files